

Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Summary Review of Monthly Reports*
for
SOIL CONSERVATION SERVICE RESEARCH **
FEBRUARY 1950

EROSION CONTROL PRACTICES DIVISION

Reducing Soil Losses from Grain - O. E. Hays, La Crosse, Wisconsin,-
"Severely eroded land is cropped to a C-G-H-H- rotation with varying organic matter treatments to determine their effect on soil and water losses and on crop yields. Particular interest is in the effect of these treatments on soil losses from grain as data obtained during the past ten years show that during eight of these years the soil losses from spring grain were higher than from corn.

"The following treatments were applied to corn following hay and to oats.

Treatment	Soil loss Tons/acre	Runoff Inches	Oats Yield Bu./A.
No manure - plowed	3.3	3.8	82
5 tons/acre manure plowed under.	1.3	2.9	75
5 tons/acre manure surface applied-plowed. . .	0.4	2.0	76
No manure - tilled with field cultivator . . .	0.8	2.6	65

"These data are the averages of duplicate plots which have been cropped to C-G-H-H since 1940. The effect of barnyard manure is apparent, whether it is plowed under or applied to the surface, but greater where surface applied. Soil loss was only 1/8 and runoff 1/2 as much with manure on the surface. It would seem from these preliminary data, that the Wisconsin farmer could well afford to steal some manure from the corn for his grain, from a conservation standpoint.

"Preparing the seedbed with the field cultivator without plowing reduced the soil loss from 3.3 to 0.8 tons per acre and runoff from 3.8 to 2.6 inches. This could be a combination effect of residue left on the surface for corn and corn stubble residue for grain. Yield of oats was depressed by the manure application, possibly by decreasing nitrogen and/or by poorer stand of grain. More study is necessary to draw a definite conclusion.

"In another experiment, some of the corn land was fall plowed and some was tilled with the Graham-Hoeme cultivator. Yield of oats was 101 and 86 bushels per acre, respectively, for the Graham-Hoeme and the plowed."

* This report is for in-Service use only and should not be used for publication without permission from the Washington Office, Soil Conservation Service Research.

** All research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

Stubble Mulch Studies + Green Bugs and Dry Weather - C. J. Whitfield, Amarillo, Texas.-"During the past three months a total of but .69 inch of precipitation has been received. None of this rainfall was of any value in replenishing the soil moisture. In addition, the last half of the month saw the development of a green bug infestation which, coupled with the deficient moisture, has reached serious proportions.

"Moisture determinations in the top 4 feet of soil during the first week of the month were somewhat variable and unreliable because of an uneven loss of moisture from the soil due to widespread development of large cracks, but gave a fair indication as to the course the soil moisture supply has taken since the last sampling date on October 10. The erratic moisture situation in the soil was also evidenced by the appearance of irregular brown patches in the fields which are apparently due to drought damage.

Soil Moisture in Inches per Top 4 Feet of Soil in Stubble Mulch Plots

Crop	Tillage	Available Moisture		Moisture Change from October to February (Inches)
		Inches per 4-feet of soil October 10	February 2-7	
Continuous Wheat	Subtillage	3.36	1.11	- 2.25
	Oneway	2.42	1.50	- 0.92
	Hoeme plow	2.62	0.87	- 1.75
Wheat on Fallow	Subtillage	4.72	3.06	- 1.66
	Delayed subtillage	5.19	2.80	- 2.39
	Oneway	4.48	3.00	- 1.48
	Hoeme plow	5.04	3.09	- 1.95
Fallow	Subtillage	1.78	1.65	- 0.13
	Delayed subtillage	1.49	1.54	/ .05
	Oneway	2.06	1.15	- .91
	Hoeme plow	2.37	1.73	- .64

"Moisture losses from the plots appeared proportional to the amount of available moisture in the soil in early October. In the case of continuous wheat, the sparse stand of wheat on onewayed land was probably partially responsible for the smaller loss of moisture as well as the fact that the plots had less available water in October. The fact that wheat on onewayed fallow plots is in a noticeable less thrifty condition than that on onewayed fallow may be the explanation of the smaller use of moisture by wheat on onewayed fallow. The delayed fallow plots had been depleted of moisture by early October due to the fact that they were grown up to pigweeds. Since that time no apparent loss of moisture has occurred."

Effect of Cultural Methods and Cropping Systems on Degree of Aggregation - O. W. Beale, Clemson, S. C.-"Aggregate analyses of soil samples from the lespedeza rotation plots were completed and the data are summarized in the table on the following page. The 4-year rotation is: Cotton-wheat, Kobe lespedeza-Corn-Wheat, Kobe lespedeza. Mulch and conventional clean tillage methods are compared each year on the cotton and corn following Kobe lespedeza and wheat. There are 4 additional plots in continuous cotton.

1949 Crop	Preceding Crop	Cultural Method	Degree of aggregation of the soil 9-22-49
Corn	lesp.-wheat	mulch	40.5
Corn	lesp.-wheat	clean	32.3
Cotton	lesp.-wheat	mulch	43.1
Cotton	lesp.-wheat	clean	34.1
Cotton	cotton	clean	30.6
lesp.-wheat	corn	mulch	52.8
Lesp.-wheat	corn	clean	46.4
lesp.-wheat	cotton	mulch	45.9
lesp.-wheat	cotton	clean	40.8

Brush Suppression for Improving Water Conservation and Beef Production in the Red Plains - Harley A. Daniel, Guthrie, Oklahoma.-"In the Red Plains about 18 million acres are unproductive simply because they are covered with scrubby, woody vegetation which does not give the grass a chance. Oklahoma has some 10 million acres covered with scrubby oak and other woody brush, and such wasteful intruders are common throughout the western and southwestern states. While not all this land can be safely cleared because of erosion hazards, a tremendous amount can be improved.

"Where selective herbicides are properly used the land cover is not destroyed. Leaves, twigs and stems of black-jack and other oak brush sprayed with a mixture of 2,4-D and 2,4,5-T all accumulated in a mulch on the soil. There was an average of 7,593 pounds per acre of litter two years after the treatment. The mulch conserves water and makes conditions favorable for the growth of big bluestem and other grasses. Measurements made during an eight-year period show that 45 percent less water ran off annually from good grass on cleared land than from an adjacent area of brushland

"These native grasses grow largely from the few spindling plants intermingled in the brush. The yield of grass in 1949 was 2,836 pounds per acre from the plots sprayed in 1947 on the Red Plains Station. This yield was equal to that of virgin meadows, and about five times more than that on adjacent brush land.

"Similar land cleared mechanically has produced an average of 66 pounds of beef per acre during periods of summer grazing the past six years. The lowest seasonal production was 59 pounds of beef and the highest was 80. This production of beef is 1.65 times more than that produced on an adjacent regressed eroded pasture. The cattle harvest the grass and make beef and milk; and the grass slows down runoff water, conserves moisture and protects the soil."

Fall Seeding of Sweetclover - J. R. Johnston, Temple, Texas.-

"Fall planted biennial sweetclovers in winter grain have come through the winter in excellent shape. The seeding of biennial sweetclover in fall planted winter grain holds great promise for conservation farming in large areas in Texas. By concentrating the sweetclover in the drill with the fibrous-rooted grain and in close proximity to the phosphate fertilizer band good resistance to winter injury of the legume seedlings is obtained."

Corn Yields in Relation to Tillage and Cropping Practices as Affected by Phosphate Applications - F. L. Duley, Lincoln, Nebraska.-"The following table gives the corn yields obtained in our plot tests this year. Tests are reported where treble-superphosphate was applied at about 50 pounds per acre. On the grain rotation plots where no legume is used phosphate reduced the yield in all cases on both the subtilled and plowed land. In the sweet clover rotations there were increases for phosphorus in most cases. This appears to be the result of supplying more available nitrogen with the sweet clover and thus increasing the need for phosphorus. The highest yields were obtained on land broken out of alfalfa one or two years. In these areas the yields from sub tillage and plowing were practically identical. The poorest yields were from an area broken out of grass where the nitrogen deficiency was very striking throughout the season.

Corn Yields 1949 - Lincoln, Nebraska

Field	Treatment	Subtilled		Plowed		Increase for Phosphate	
		Phos.	No Phos.	Phos.	No Phos.	Subtilled	Plowed
Rotation	No Residue - Ck.	--	--	39.7	43.3	--	-3.6
No Legume	Residues - Annually	42.2	46.7	43.8	46.4	-4.5	-2.6
No Legume	Plowed for wheat subtilled for corn	39.0	42.8	--	--	-3.8	--
No Legume	Subtilled for wheat spring plowed for corn	--	--	32.0	39.8	--	-7.8
23-I-W	Sweet clover 1 year corn after sorghum	69.4	67.2	74.0	70.7	2.2	3.3
23-I-E	Sweet clover 1 year corn after corn	70.0	64.7	72.0	72.0	5.3	0.0
24-IV-E	1 year sweet clover corn	55.7	56.3	64.1	53.7	-0.6	10.4
25-III	2 year sweet clover corn	76.1	70.1	75.5	73.8	6.0	1.7
24-C	Second year corn after alfalfa		77.8		78.2		
24-B	First year corn after alfalfa		79.6		79.1		
B-6	Corn after old brome		22.2		22.5		
Hastings	Corn after 2 yr. S.Clover		40.9		40.8		
Mean increase for phosphate						0.7	0.2

Cropping Systems and Maintenance of Soil Fertility - D. D. Smith, Columbia, Missouri.-"Mr. Whitt discussed cropping systems and maintenance

of soil fertility at Annual Soil District Cooperators Meetings in Johnson and Clark Counties on February 2 and 21, respectively. Following is a brief of the material he presented.

'If we as farmers wish to maintain our production capacity, we must maintain or raise our soil fertility. Fertility is so intimately a part of the soil that when we lose the soil itself, our fertility goes with it. As a matter of fact, the soil we lose in Missouri is higher in fertility than the soil which remains. On the average, nitrogen content is two to three times, phosphate three times, and potash twice as high in the runoff as it is in the soil.

Our data at the Midwest Claypan Soil Conservation Experiment Farm show, however, that surface soil has a value over and above that of furnishing plant nutrients. Where a good depth of surface soil remains, more effective, efficient, and economical use is made of commercial fertilizer. Surface soil provides 'better living quarters' for the plant - better air and water relationships and other desirable physical properties.

We have some tools to help us in saving soil and hence fertility. Among them are terraces, strip cropping, contouring, and cropping systems. All of these are important, but you have asked for a discussion of the latter.

Cropping systems may be designed to keep soil covered as much of the year as possible. Fit crops together so one follows the other quickly. Use winter cover crops between row crops. Don't grow a crop when a less erodible one will serve the farm enterprise just as well.

Largest soil losses - and greatest opportunity for saving soil - occur when row crops occupy the land. Condition your soil to resist erosion during this period. This is done by growing grasses and legumes before row crops.

Missouri is losing an estimated \$192 million of plant nutrients through erosion annually. We shall never be able to maintain our soil fertility economically until this loss is drastically reduced. We believe it is better to save the soil which we have, and to supplement its deficiencies with commercial fertilizers, than to farm wastefully and thus require higher rates of fertilizer for sustained yields.' "

Can We Plow and Forget Previous Treatment? - G. R. Free, New York. - "Just about one year ago, we helped a neighbor near the Marcellus Station pull his tractor out of the mud. He had been spreading manure and was mired in soft ground so that the tractor seat was about at ground level. We began to wonder just how much good was being done by spreading manure under such conditions and whether all effects of traffic would disappear with a little freezing and thawing and with the spring plowing done under good conditions. Small plots in sod and in corn stubble

in the same field were subjected to moderate traffic with a wheel-type and with a track-type tractor that same day. We did not get mired. Yields of corn harvested last fall were as follows:

Traffic in Winter	Corn Yields - Bushels per acre	
	Following Sod	Following corn
None	79.6	70.0
Track-type tractor	89.2	59.3
Wheel-type tractor	79.8	47.3

"This was not a formal experiment with full replication and all the trimmings and the results should be interpreted with this in mind. The data suggest, however, that there is considerable difference in the effect of traffic on sod and on corn stubble. We have heard several times that a winter cover crop in corn has helped in supporting harvesting equipment. Perhaps it also helps in preventing damage to soil. Apparently subsequent freezing and thawing cannot be depended upon to correct the damage. The frost may penetrate deeply on wind-swept, exposed areas, but, on part of the cropland at Marcellus, the soil has never been frozen deeper than 4 inches. Usually the depth of frost penetration has been much less than this. It may pay to make a more thorough investigation of the damage from traffic of different equipment at different times of the year."

Winter Grazing - B. H. Hendrickson, Watkinsville, Ga.-"During the dry but mild 'winter grazing period' of 4 months, November thru February, several of the Station's small upland pastures have furnished an average of .5 to .6 cow unit per acre full feed grazing.

"These are pastures on Class IV land previously improved by several years growth of kudzu or sericea, both oversown to one or more winter grazing crops including rescue, rye, orchard and tall fescue grasses, crimson and bur clovers, vetch and Caley peas.

"Seventy acres in pastures, averaging 48 acres in use monthly, furnished intermittent rotational grazing by a breeding herd of Angus cattle numbering 38 cow units.

"To avoid overstocking the pastures, supplemental cow lot feeding was required on 54 of the total of 120 days during this period.

"If the cow unit - pasture acre ratio is maintained at 1:2 during the winter grazing period, previous 4 years' experience has indicated that it is advisable to plan for at least 1-1/2 months of supplemental feeding of beef cattle during cold spells when cool weather forage plants can make little or no new growth.

"This is believed to represent a fair picture of winter grazing on an average Southern Piedmont farm, when only nominal but consistent fertilizer applications are made to originally very poor pasture lands. Heavy rates of fertilization, involving higher costs, would doubtless increase cool-weather forage crop yields, but this practice is questionable from the economic standpoint in beef cattle production."

Ease of Separation and Transportation of Certain Soils - C. A. Van Doren, Urbana, Illinois.—"One factor contributing to the erosion process is the ease of separation of soil particles. Another factor is the ease with which the particles are transported. Some preliminary work started in 1948 was continued in 1949. The separation values reported below represent the relative splash of soil particles out of 3-1/4 inch diameter containers compared with the amount of splash from 60-70 mesh sand expressed as unity:

Soil:	Ave. 17 tests (40 rains)
Sand (60-70 mesh)	1
Onarga fine sandy loam	0.63
Elliott silt loam (Joliet)	0.45
Flanagan silt loam (Urbana)	0.44
Grantsburg silt loam (Dixon Springs)	0.23

"The surprising thing about these tests is the relative ease of separation of the soil from the Urbana plots as contrasted to the Dixon Springs soil. Since the Grantsburg soil is low in organic matter and finely disbursed, one would expect the Grantsburg soil particles to splash in greater quantities than the Flanagan. Observations indicate that the Grantsburg soil tends to pack and particles become cemented which helps this soil to resist raindrop action.

"Plot tests show that Grantsburg soil erodes more than the Flanagan. This is undoubtedly due to differences in rainfall characteristics and in ease of transportation of soil particles.

Soil and Water Loss in Relation to Crops: "An exploratory study was conducted for a three year period to determine the effect of frequent cultivation (fallow) on soil and water losses. Small 6' x 12' runoff plots were established on both 5 and 9 percent slopes. A three year rotation of corn, winter wheat (lespedeza), and lespedeza was compared to fallow and bare plots. The fallow plots were frequently cultivated about one inch deep. The bare plots were scraped to control weeds in 1947 and were treated with weed control chemicals in 1948 and 1949. The results expressed in percent of rainfall in runoff and relative soil losses compared with fallow plots were as follows:

	5% Slope		9% Slope	
	Runoff % of rain	Relative Erosion (Fallow = 100%)	Runoff % of rain	Relative Erosion (Fallow = 100%)
Corn	7.8	52	9.3	71
Winter Wheat	19.9	14	11.6	9
Lespedeza	7.7	1	3.9	0.3
Fallow	33.1	100 ⁽¹⁾	27.4	100 ⁽¹⁾
Bare	42.9	149	52.6	111

(1) The fallow plots lost the following total amounts of soil during the three seasons: 5%, 18.4 tons per acre; 9%, 44.9 tons per acre.

"These data emphasize the importance of crops in humid areas in reducing soil and water losses. We expected soil losses to be greater from fallow plots which were cultivated frequently than from the bare, uncultivated plots. The greater soil losses from the bare plots than from the fallow plots may be attributed to the increased runoff."

Winter Cover Crop Tests on Light Textured Tobacco Soils - C. S. Britt, Beltsville, Maryland.-"This work is being carried out with continuous tobacco on ridge rows. Winter covers of wheat, rye and ryegrass mixed with vetch are being compared with vetch alone, ryegrass alone and no cover. The covers are all turned on two different dates; early turning being done the middle of April and late turning the middle of May. Air-dry weights of top growth from samples taken immediately before turning are in table 1 along with the amount of vetch contained in the mixtures.

Table 1.--Air-dry top growth of various winter covers at different plowing dates with proportion of vetch shown from the mixtures. Average of two replications. Beltsville, Maryland, 1949. (Early plowing on April 11 and late plowing on May 11).

Cover Seeded	Pounds Per Acre		Percent Vetch in Mixture	
	Early Plowing	Late Plowing	Early Plowing	Late Plowing
None 1/	---	732		
Ryegrass	955	1276		
Vetch	1348	2798	100	100
Wheat-Vetch	1187	2909	64	67
Rye-Vetch	1883	6559	39	24
Ryegrass-Vetch	1107	2686	66	89

1/ Grass and weeds volunteered before late turning.

"The greatest amount of top growth material was furnished by the rye-vetch mixture at both dates of turning. Tobacco yields were very good even though the 1949 season was unusually dry with only about 7 inches of rain during the season as shown in table 2.

Table 2.--Yields of tobacco grown continually with different winter covers and two dates of plowing, Beltsville, Maryland. (Average of two replications -- early plowing the middle of April and late plowing the middle of May)

Cover Seeded	Tobacco Yields Pounds/Acre			
	1949 Season		Average 4 Seasons	
	Early Plowing	Late Plowing	Early Plowing	Late Plowing
None	938	920	1049	1004
Ryegrass	1074	931	1119	999
Vetch	1203	1508	1362	1563
Wheat-Vetch	1101	1495	1262	1437
Rye-Vetch	1535	1671	1390	1484
Ryegrass-Vetch	1406	1733	1309	1544

"The late plowing of all covers containing vetch continued to give yield increases over early plowing of the same covers. The late plowing of ryegrass alone continued to decrease the yield when compared to early plowing of ryegrass.

"The quality of the tobacco for last season has not been determined; however, in the past the sale price per pound for the various covers has generally been higher with the late turning. The ryegrass alone has sold for the same price per pound following early and late turning."

Percent Protein in Wheat in Relation to Stubble Utilization - Hugh C. McKay, St. Anthony, Idaho. - "The percent protein in the wheat was high due to the lack of precipitation during the growing season. However, the same differences occurred as in previous years as shown in table 1.

Table 1.--Percent protein in Komar Spring wheat from Various Tillage Practices 1949.

Tillage Practice	Residue Treatment		Average
	Stubble Utilized	Stubble Burned	
Moldboard	15.06	15.89	15.47
One way disk	15.05	15.76	15.40
Subsurface plow	14.14	15.27	14.70
Average	14.75	15.64	
One Way Disk			
2000 lbs. straw	15.35		
4000 lbs. straw	15.28		
75 lbs. Am. Sul.	16.08		

"The above table shows that utilizing the residue, reduces the protein in the wheat by about 1% as compared to when the residue was burned. Utilizing the residue on the surface as a mulch reduces the protein about 1% as compared to when the residue is mixed with the surface soil or when it is plowed down. In years such as this when the protein is high, this difference does not effect the price received because no premium is paid above 14% protein. However, in years when the protein is lower, this spread in protein means considerable to the farmer as the hard red wheat in this area is sold on a percent protein basis.

Percent of Protein in Wheat as Affected by Soil Conserving Legume Grass Rotations - "The use of soil conserving legume grass rotations increased the percent protein considerably over the normal fallow as shown in table 2.

Table 2.--Percent protein in Wasatch winter wheat following various soil conserving legume grass rotations - 1949.

Rotation	1st crop after legume or grass	2nd crop after legume or grass	3rd crop after legume or grass	Average increase over check
Sweet clover	17.09	14.97	17.47	2.22
Sweet clover-grass	17.61	12.19	16.69	2.09
Grass	17.99	15.19	16.34	1.45
Alfalfa	19.39	16.37	17.17	2.59
Alfalfa-grass	19.41	16.23	17.81	2.76
Check	15.01	15.06	15.06	
* Spring wheat not included in average				

"The largest increase in protein was found in the first crop of wheat following legumes. The second crop showed the least response, this was different than expected, it was thought the third crop would show the least response. The alfalfa-grass rotation showed the highest response with an average increase of 2.76 percent over the check. The straight grass rotation showed the least with an increase of 1.45 percent. In normal precipitation years the straight grass rotation usually shows a decrease."

Comparison of Winter Cover Crops in Relation to Sweet Corn Yields - O. R. Neal, New Brunswick, New Jersey.--"The 1949 season constituted the 5th year of a study comparing winter cover crops of rye, ryegrass, and a mixture of ryegrass and vetch. The areas are cropped annually to sweet corn. Yields of sweet corn following these cover crops are shown in table 1.

Table 1.--The effect of winter cover crops on sweet corn yields

Cover Crop	Yield - No. 1 ears per acre	
	1949 Season	1945-1949 Average
Rye	6430	7180
Ryegrass	5420	6050
Ryegrass and vetch	8520	9710

"Runoff and soil loss measurements are not made from these plots. However, each of the cover crops ordinarily makes sufficient growth to provide good soil protection during the winter season. Conservation effectiveness during cultivated seasons, resulting from the winter cover, might be expected to be greatest from the ryegrass-vetch mixture. The increased corn growth would provide better vegetative canopy. Furthermore, results from numerous other studies have indicated that the soil physical conditions most favorable for crop growth on this soil are identical with the physical conditions most effective in conserving soil and water. The increased growth and yield of sweet corn following the ryegrass-vetch cover crop indicates that soil conditions were particularly favorable following that treatment."

Early Growth of Wheat in Relation to Seeding Dates and Soil Moisture - A. E. Lowe, Garden City, Kansas.-"The result of dry weather on the wheat was most interesting as the dry soil tended to retard growth whereas the high daytime temperature stimulated growth. The result in general is that spring wheat growth on some fields started in February and earlier than usual and on other fields it had barely started by the end of February.

"The difference in growth depends on surface soil moisture which in turns depends on the amount of fall growth the wheat made which in turn is dependent on how early it was planted. As an example wheat plated on the station the middle of August on summerfallow land wet to a depth exceeding six feet had made very little spring growth to the end of February. This same wheat was very rank last fall and has taken the soil moisture out of the surface 3-1/2 to 4 feet. In direct contrast the same rate and variety of wheat on the same field but planted October 15 had made nearly three inches of spring growth by the end of February which is an unusually large amount for the time of year. It had made little growth last fall and had exhausted the moisture from only the surface six inches of soil. Perhaps this is best seen in the following table.

Date Planted	Estimated Fall Growth	Estimated Spring Growth	Depth of Dry Surface Soil
August 13 Unpastured	15"	Trace	3.5'
August 13 Pastured	3"	1"	2.5'
Sept. 2	6"	1"	2.5'
Sept. 15	5"	2"	1.5'
Oct. 1	4"	3"	.5'
October 15	3" (a)	3"	.5'

(a) Very little stooling in fall and only few secondary roots formed.
All other dates stoolled well and rooted well.

"The farmers' fields reflect the same condition as some have abundant fall growth with little spring growth whereas others have little fall growth but abundant spring growth."

Panel Discussion: Income and Cost Considerations in Legume-Grass Production - E. L. Sauer, Urbana, Illinois.

"1. Needs for a larger acreage of legumes and grasses: For the past three years, approximately 55 percent of Illinois' cropland was in corn and soybeans, 20 percent in small grains and 20 percent in hay and pasture. In some central and east-central Illinois counties as much as 75 percent of the cropland was in corn and soybeans and as little as 8 percent was in rotation hay and pasture. Legumes and grasses are of prime importance in fertility improvement and in soil

and water conservation and erosion control. A sound long-time land use program for Illinois would involve an average of no more than 40 percent of the cropland in corn and soybeans and at least 35 percent in rotation hay and pasture.

"2. Costs of securing larger acreages of legumes and grasses - Studies of a large number of farm records show that it costs from \$20 to \$40 an acre to adopt a complete conservation program. Approximately 75 percent of this average cost is for the limestone and phosphate which must be applied to get the good stands of legumes and grasses necessary for soil fertility improvement. Water disposal practices, including grass waterways, terraces, drainage, and other practices, generally make up the balance of the cost of a conservation program.

"It also costs the farmer in terms of capital losses to not adopt a conservation program involving larger acreages of legumes and grasses. Plant food losses from crops grown show that farms with low acreages of legumes and grasses are depleting their soil resources at a rapid rate in addition to promoting sheet and gully erosion. A five-year study of a group of central Illinois farms shows that those with a high proportion of land in hay and pasture had a net loss of plant food removed by crops of 54 cents per acre compared to \$2.67 for the farms having only half as much land in legumes and grasses. The plant food lost from erosion was over eight times as high on the farms with a low proportion of land in legumes and grasses.

"3. Benefits of more legumes and grasses - "Studies in several areas of physically comparable high- and low- conservation farms show that crop yields and total farm production of crops are higher on the farms having the larger acreage in legumes and grasses. Corn yields were increased from 5 to 16 bushels per acre by areas on the farms having rotations in accordance with land-use capability recommendations, compared with those farms following the usual system of farming.

"Livestock production and returns per \$100 feed fed to livestock were consistently higher on the farms having the larger acreage of legumes and grasses.

"Net farm incomes over a long period of time averaged from \$3.46 per acre to \$7.39 per acre higher on the farms following a recommended conservation program involving adequate acreages of legumes and grasses, compared with physically comparable farms not following a recommended conservation program.

"4. Problems of Securing larger acreages of legumes and grasses. The capital required to start a conservation program, the high proportion of tenant-operated farms, and the natural tendency in certain areas for cash-grain farming constitute the major problems of securing adequate acreages of legumes and grasses.

"5. Benefits of more legumes and grasses in a cash-grain system of farming - More livestock may be necessary to utilize increased acreages of legumes and grasses in a conservation program. However, not all farmers should increase their livestock, for they may not possess the skills needed for efficient livestock production. Numerous case

examples are available to show how farmers have increased their total farm production of grain crops and their net farm income by using increased acreages of legumes and grasses solely for soil fertility improvement. This has been particularly true on farms where the fertility was at a low level and where a major part of the land was in corn and soybeans. On some farms corn yields have been doubled by leaving from one-fourth to one-third of the cropland in stands of legumes and grasses and by plowing these down for soil fertility improvement and erosion control.

"6. Summary. A good soil fertility improvement program will result in additional hay and pasture. To utilize the hay and pasture, the number of roughage-consuming livestock may have to be increased. Numerous cases can be cited where cash-grain farmers have profitably utilized increased acreages of forage crops for soil fertility improvement. On the average farm, returns probably will be greater if the increased forage crops are utilized through livestock.

"The farms with the most legumes and grasses had higher livestock efficiency as measured by 'returns per \$100 of feed fed.' Does this fact reflect better livestock management or better feed? It is felt that the better-quality feed supplies--grain, hay, and pasture--explain the greater efficiency.

"More legumes and grasses do not necessarily increase earnings immediately. Considerable effort and money must usually be expended before positive results are achieved. The long-time benefits, however, are certain. Over a long-term period farms that have spent more money for soil and related improvements have more land in legumes and grasses, have higher crop yields, produce more and better-quality hay and pasture, feed more livestock, have higher livestock production and returns, and secure larger net farm income."

NOTE: Maurice Donnelly of Riverside, California is the author of "Improving Soils Underlain by Shallow Claypan", on page 2 of the January, 1950 Monthly Reports. His name was inadvertently omitted.

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio.-"In preparing revision to a report, 'Hydrology of Surface Supplies to Runoff,' a special study was made of hydrographs from cornland. Mr. Schiff reports that infiltration curves revealed the effect of surface sealing. It was interesting to note that heavy rainfall on very dry bare soil will be absorbed slower than heavy rainfall on wet bare soil. The 'slaking' as well as the mechanical dispersion on a very dry soil quickly sealed the soil surface.

"In connection with studies of watershed overland flow and erosion studies it was noticed that some of the relationships were developing contrary to previous concepts. Mr. Schiff points out that for identical runoff rates, the average depth of detention storage on the watershed on the rising side of the hydrograph was found to be noticeably greater than that for the falling side. Practically all previous work on hydrograph analysis has used the assumption that both rising and falling sides of the hydrograph had the same detention-discharge relationship. The magnitude of this difference is exemplified by the following equations for a large storm on a 2-acre watershed:

$$\text{Rising side of the hydrograph: } q = 21.6 D_a^{2.89}$$

$$\text{Falling side of the hydrograph: } q = 4.31 D_a^{0.974}$$

q = runoff rate

D_a = average depth of surface detention.

These differences appear to be reasonable - more so than the earlier assumption.

"Mr. Pomerene reports that in connection with the contour fence, measurements of post positions and tension made February 20, 1950, at a temperature of 15° showed no important change in post positions. Since August 11, 1949, when measurements were made at a temperature of 85° there has been a decrease in tension in Sections B, E, and F, no change in Section A, and increases in tension in Sections D, G, G', and G''. Apparently the sections with short radii have lost tension during this period (except Section A no change) while the sections with longer radii have increased tension due to contraction with decrease in temperature.

"These changes in tension do not seem to be important and except in Section F are not apparent to the eye. In Section F there seems to be a slightly slack section near the measuring point.

Hydrologic Studies - R. W. Baird, Blacklands Experimental Watershed, Waco, Texas.-"Rainfall for the month of February totaled 3.59 inches compared to a normal of 2.37. Of this rainfall almost one-half occurred during the hour between 0500 and 0600, February 12. This storm of February 12 caused the highest rates of runoff at most stations since 1946. Table 1 shows the rainfall and runoff for this storm as well as for the entire month of February. This table appears on the next page. The amount of runoff from the various areas does not reflect directly the effect of conservation practices but probably comes nearer indicating the amount of the area that has been filled almost to capacity or where there is a tendency for seepage flows. For example, the areas Y-7, Y, W-1, and W-2 include appreciable areas of seepy land, and the total volume of runoff from these four areas is much larger than for any of the other areas on the Government-owned land. Most of the runoff occurred during the storm of February 12, and with the higher intensity and previous rainfall, the volume of runoff from pasture

Table 1.--Rainfall and runoff - February 1950

Land use	Area	Acres	Ordinary farm practices										Conservation practices									
			SW-12	SW-17	W-10	W-6	W-2	W-1	Y-10	Y-8	Y-6	Y-7	Y-4	Y-2	Y	C	D					
			2.97	2.99	19.7	42.3	130	176	21.0	20.3	20.9	40.0	79.9	132	309	579	1,110					
Monthly:																						
Rainfall			3.400	3.610	3.660	3.410	3.509	3.600	3.586	3.540	3.542	3.601	3.567	3.538	3.512	3.915	3.865					
Runoff			.7161	1.2905	.9139	.9523	1.3582	1.1518	.8936	.6820	.7779	1.3322	.9273	.8631	1.4975	*1.3386	*.9609					
Difference			2.6839	2.3195	2.7461	2.4577	2.1508	2.4482	2.6924	2.8580	2.7641	2.2888	2.6397	2.6749	2.0145	2.5764	2.9041					
Feb. 12:																						
Rainfall			1.780	1.960	2.000	1.900	1.939	1.944	1.983	1.910	1.912	1.907	1.955	1.922	1.884	1.865	1.879					
Runoff			.7161	1.2897	.9082	.9522	1.1679	1.0856	.8806	.6819	.7745	1.3177	.9202	.8568	1.4657	1.2738	.9266					
Difference			1.0639	.6703	1.0918	.9478	.7711	.8584	1.1024	1.2281	1.1375	.5893	1.0348	1.0652	.4183	.5912	.9524					
Peak runoff																						
rate			2.27	3.58	2.19	1.87	1.60	1.88	.888	.682	.973	1.98	.937	.947	1.29	.659	.374					
Time of																						
peak			0546	0542	0526	0546	0551	0550	0549	0553	0550	0551	0055	0549	0600	0625	0642					

*Some seepage flow after February 14 not included.

and meadow lands was quite high. Actually it seems that pasture lands that have been grazed quite closely had more runoff than areas which are in cultivation. This is an unusual situation but one which can be expected occasionally during the winter months.

"Table 2 shows the peak rates of runoff for certain of the areas compared to the peak which we would estimate for a 2-year recurrence interval from the data in the bulletin recently prepared. For most areas the discharge is almost that for a flood of a 2-year recurrence interval, but for areas W-1 and Y it is appreciably higher. I have also shown in this table the estimated peak runoff rates for the areas with conservation practices had no conservation practices been established at the time of this storm.

Table 2.--From data in bulletin and storm of February 12, 1950

Area	Land use	Size in acres	Discharge from bulletin data for 2-year recurrence interval	Actual discharge: Feb. 12	Discharge corrected for effect of conservation practices
			c.f.s.	c.f.s.	c.f.s.
W-1	Ordinary farm practices	176	269	333	
W-2	" "	130	223	210	
W-6	" "	42.3	89.3	79.8	
W-10	" "	19.8	50.8	43.8	
Y	Conservation practices	308	382	402	527
Y-2	" "	132	226	126	192
Y-6					
Y-8	" "	20.0	50.8	17.1*	29.2*
Y-10					
SW-17	Pasture established 1948	2.99	10.7	10.8	

*Mean for three stations.

"Rains during the month increased the moisture supply down to a depth of 60 inches in cultivated areas. Upland meadows and pastures did not show as much moisture as the cultivated fields below 36 inches.

Hydrologic Studies - John A. Allis, Central Great Plains Experimental Watershed, Hastings, Nebraska.--"On February 12 and 13, a rain followed by snow yielded 0.35 inch of precipitation at our meteorological station. Prior to this, in the 124-day period, we had only 0.16 inch of moisture since October 11, 1949. This may be the driest period since the beginning of record in Hastings since 1895, judging from the total monthly catch, however, the daily readings are not readily available. On February 28, we had a light rain of 0.17 inch making the total precipitation in February only 0.52 inch.

"In February a considerable portion of time was spent in compiling 1949 figures for the progress report, which was submitted on the last day of the month. Contouring and sub tillage continued to show a reduction in peak rates of runoff from the 21 small 4-acre watersheds farmed under field conditions. The total runoff and peak rates from pasture plots continued to give significant results, which are as follows:

Table 1.--Peak rates and total runoff from pasture plots for calendar year 1949

Treatment	Average maximum peak rate of runoff	Total runoff
	Inches per hour	Inches
Untreated	0.85	1.91
Renovated with eccentric disk	.58	.97
Furrows, 12-16' H. spacing	.19	.30
Furrows 4-5' H. spacing	.08	.17

Hydrologic Studies - R. B. Hickok, LaFayette, Indiana.--"This report is submitted to cover both January and February. Total precipitation at the Purdue-Throckmorton Farm was over 9 inches in January, almost four times the 'normal' and by far the highest January precipitation on record for LaFayette. February precipitation totaled 4-1/4 inches, almost double the local 'normal.' The very high rainfall was general and resulted in a series of important floods on the Wabash and other rivers.

"There were several storms producing large amounts of runoff from our experimental watersheds. Despite icing of measuring and sampling equipment and the necessity for de-icing, recorder chart changes, and emptying of runoff sample tanks under difficult weather conditions, to be ready for the next storm, few records were lost and we secured an unusual and very valuable set of records relating to winter flood conditions.

"The SCS flood control survey party at Indianapolis, under the direction of Mr. J. D. Parsons, has furnished a man for a month's time to aid our staff in the enormous volume of tabulating and computing involved in working up these data; and the Agricultural Engineering Department of the Purdue Station has assumed the expense of continuing the extra help until the job can be completed.

"A manuscript, 'Mulch Tillage for Corn and Some of the Problems Involved,' by E. R. Baugh, R. B. Hickok, H. Kohnke, I. D. Mayer, was revised for publication in AGRICULTURAL ENGINEERING. (The paper was presented at the meeting of the Soil and Water Division of ASAE in Chicago by Mr. Baugh in December).

"A brochure, 'Conservation Pays' was compiled showing the extra costs for conservation treatment of experimental watersheds at LaFayette in comparison with reduced fertility losses by erosion and increased crop yields. It was determined that the net return of the conservation treatment has averaged \$11 per acre per year for all land in the crop rotation (C-Sb-W-M) on the basis of current prices. The return for the past year was \$20 per acre.

Hydrologic Studies - Geo. Crabb, Jr., East Lansing, Michigan.--"Precipitation for the month of February as measured by the U. S. Weather Bureau standard non-recording rain-gage amounted to 2.89 inches at the cultivated watershed, 3.10 inches at the wooded watersheds, and 3.50 inches at the stubble mulch plots. These amounts are approximately 152 percent, 163 percent, and 184 percent of the 50-year average February precipitation of 1.90 inches. February precipitation can be expected to equal or exceed 2.89 inches once in 7.5 years. There were 10 run-offs during the month 4 at the cultivated watershed 'A', 4 at the cultivated watershed 'B,' and 2 at the wooded watershed.

"February 13 through the 28th, the Project Supervisor was on military leave, and assigned to duty at the Office of Naval Research, First Naval District, Boston, Mass. An attempt was made, while on duty, to review the literature pertaining to the Navy's participation in the field of solar radiation (one of the basic studies of this project) and insofar as possible to correlate these studies with those underway under project and U. S. Weather Bureau auspices. It was found that the Navy has participated in pyr heliometric work to some extent, and evidently intends to continue to do so, but along lines of little or no value to climatologic or hydrologic investigation. The Project Supervisor made certain recommendations of possible applications of pyr heliometric data in which the Navy might be interested, and listed the known sources of pyr heliometric information in the United States, Canada, and Mexico.

"He also presented abstracts of Naval research work along these lines. Conferences were arranged between Office of Naval Research personnel, U. S. Weather Bureau Solar Radiation Section personnel, and Soil Conservation Service personnel with an eye towards developing more full and complete cooperative relationships between these agencies."

Hydrologic Studies - A. J. Cooper, Auburn, Alabama.-"The February rainfall of 3.38 inches represents 61 percent of the 69-year average of 5.51 inches for Auburn.

"Moisture content measurements were made of soil in the plots used to study the effect of tillage and residue management on the physical properties of soil. The moisture content will be determined each month in the future. While the moisture content varied between plots, no significant conclusions could be drawn.

"Analyses were made of the data obtained to date to determine the effect of various type storms on soil and water losses--study R-2-3-1(j). Tests to date indicate that the percent runoff is proportional to the initial moisture content of the soil but varies very little with the time that the highest intensity rainfall occurs. No correlation could be made between soil losses and initial moisture content or the pattern of rainfall. The method of determining soil losses was checked and found to be in error. In future tests all soils will be saved, dried, and weighed. Also a new procedure for running tests was decided upon.

"A meeting was held with Mr. C. M. Sanders, Drainage Engineer, and Mr. M. E. Stephens, State Soil Scientist, to see what assistance this project could give in connection with their irrigation and drainage work. Their immediate problems in designing irrigation systems is to determine the rate, amount, and time of water applications needed for the various soil types, conditions of soil, and type and stage of growth of plants. It was decided that this project might be able to furnish rate of infiltration, percolation, and water-holding capacity of the soil available to plants (difference in field capacity and wilting point). A tentative working plan is in the preparation stage to cover this work.

Hydrologic Studies - T. W. Edminster, Blacksburg, Virginia.-"Messrs. Holtan and Kirkpatrick report the following information: A good share of the period was spent in the preparation of figures for oral presentation to the American Geophysical Union meeting in May of our paper entitled 'Some Broad Phases of the Hydrology of Runoff.' Also two rather lengthy replies were prepared concerning theories and premises used in the paper as the result of comments received thus far.

"Analyses of annual amounts of runoff progressed. These data are being considered for publication as a guide to estimating dependability of supply from surface runoff to farm ponds for such regular usages as orchard spraying, heavy stock watering, heavy household usage, irrigation, etc. At this stage it appears that if surface runoff is to be used as a supply for such needs, appreciable adjustments, both in pond watershed ratio and subsequently in peak rate control concepts, will have to be incorporated. Watershed area of sufficient size to give dependable supplies yield peak rates of such magnitudes as to present difficulties in spillway capacity."

Farm Ponds - T. W. Edminster, Blacksburg, Virginia.--"Mr. Holtan reports that he went to Burlington Mills, Dublin, Va., on February 10 at the request of Mr. R. D. Porter, Senior Engineer for Burlington Mills. The problem is as follows:

"The pond of something less than 2 acres in area is used for holding refuse dye solutions until they can be passed through a filter for removal of coloring and suspensions. This pond has been leaking and a fear has been developed in spite of its harmless ingredients that discoloration of streams or the underground water supply to Dublin might result in a law suit. They are, therefore, very anxious to provide a water-tight bottom in this pond. Estimates for concrete lining range from \$30,000 to \$40,000.

"Since this is definitely not an agricultural pond but does provide good facilities, financial, mechanical, etc., for research objectives, it was not deemed necessary to go through the usual channels of contacting the zone technicians; therefore, Mr. Holtan proceeded with the investigation of this pond and the ultimate recommendations as follows:

"The pond is almost exclusively silt and this of a very narrow range in particle size. A good source of sticky clay with some silt in it is adjacently available. It was recommended, therefore, that a 6-inch layer of sand be placed over the pond floor area and thereafter a 2-inch layer of sticky clay be placed over the sand.

"A Seaman mixer is to be used to thoroughly mix the dry sand and clay. Thereafter the 6-inch layer is to be wetted down thoroughly. After a period of drying, when the mixture reaches optimum moisture, it is to be compacted with a sheepsfoot roller.

"The recommendation is far beyond any conceivable plan for a farm pond but the value of this pond to the Burlington Mills and their stated hopes of obtaining such a seal for approximately \$5,000 affords sufficient leeway to use such an exacting method to obtain the desired expectancy of success.

"Adams and Tate Construction Company of Roanoke has evidently been contacted by the Burlington Mills and they in turn have had samples of sand from the Southern Materials Company at Richmond sent to Mr. Holtan for approval. These samples were approved and evidently procurement is proceeding. Under a present arrangement, Mr. Tate and Mr. Porter will probably spend a few hours at Blacksburg prior to the beginning of work on the pond. They expressed a desire that Mr. Holtan be present during the work on the pond and it is anticipated that considerable knowledge will be obtained for research during this operation."

Hydraulic Studies - F. W. Blaisdell, Minneapolis, Minnesota.-"Authority was received during February to conduct model studies for the Region 3 Engineering Division on wingwall designs for use in connection with straight drop spillways to be used in the flood control work on the East Aldrich minor watershed of the Little Sioux River. It is anticipated that these studies will determine the relative merits of wingwalls located parallel to the center line, perpendicular to the center line or at some intermediate angle. The economy in the use of parallel wingwalls has been estimated at \$100.00 per spillway over perpendicular wingwalls if they are satisfactory from a hydraulic standpoint. Twenty-three straight drop spillways are planned for this single minor watershed of the Little Sioux River.

"The complete paper which appeared in the TRANSACTIONS of the American Society of Civil Engineers describing the 'Development and Hydraulic Design, St. Anthony Falls Stilling Basin' has been translated into German and made available to the Officer who in Bavaria corresponds with the Chief of Soil Conservation Service in this country. This translation was made by Mr. Bernhard Esterer who has sent a copy of the translation to Dr. L. G. Straub."

Drainage Studies - T. W. Edminster, Blacksburg, Virginia.-"Mr. Walker, Drainage Engineer, makes the following report: At the request of SCS Operations in Virginia, a drainage conference was held in Suffolk, Va., February 20 and 21, to discuss the trends noted by this project from its beginning to date. The drainage engineer attended this conference.

"The purpose of the drainage conference was to present to district personnel the trends noted by the Virginia Research program. Particular emphasis was given to the permeability surveys and the engineering research program.

"The procedure for the conference was in two parts. The first part took up the first day. It was attended by technical and administrative personnel from Virginia with representatives from the Regional and Washington offices. Its purpose was to discuss the various topics and organization of the program for the second part (second day). The purpose of the second part was to present information to the work unit personnel in the Peanut, J. R. Horsley, Virginia Dare and Eastern Shore Soil Conservation districts.

"In general, the program was the same for both days; therefore, comment is limited to an overall discussion.

"Mr. A. M. O'Neal of the Washington Office discussed the physical characteristics of soils that are indicative of the various degrees of soil permeability. Mr. Forrest Steele outlined how these characteristics applied to some of the Virginia soils that have been sampled. Mr. W. L. Turner, Jr., described the present method for presenting the results of the permeability survey in Virginia and renewed his proposal for modifying the same.

"The Drainage Engineer discussed engineering phases of the drainage research in Virginia. The discussion covered objectives of the project, methods of approach, limitations of present methods and proposed methods for future approach. He also discussed the trends noted in the 'quick-sand' investigations. Emphasis was placed upon the quality of tile, treatment of backfill material, care at time of installation and methods of sediment filters used when tile draining soils containing a sand strata. Mr. John Sutton of the Washington Office summed up the underlying theme of the conference by saying that the material discussed should be used as elements 'to develop a 1950 model drainage program in Virginia'."

Drainage Studies - John C. Stephens, West Palm Beach, Fla. - "Four flow measurements were made to determine seepage into the borrow ditch along levee 35-A. This levee is one of those being constructed under the Federal Flood Control Project. It begins at the North New River Canal and runs northeast to the Range line, a distance of approximately 5 miles. It is in the same vicinity as Osborne's grove, where extensive seepage tests were made by the Soil Conservation Service approximately a year ago, and the geology of the area is quite similar to that at Osborne's grove, which has been previously described.

"In building the levee, a borrow canal was excavated into the rock to furnish material. This borrow canal is approximately 80 feet wide and from 12 to 14 feet deep. When work started the ground was flooded to a depth of about 2 feet, and small muck levees were constructed parallel to the levee and borrow canal and around the ends to keep out surface flow and permit the borrow canal to be pumped down during excavation. Advantage was taken of the situation to measure the seepage pumped from the borrow canal.

"The contractors usually left a 'plug' in the canal on which the pumps sat, and pumped into the previously dug section which drained into the North New River canal. Whenever the pumped stretch exceeded about 1,200 feet, the plug was removed and the pumps set ahead for excavating the next stretch.

"Four sets of flow measurements were made. Elevations were read on the ground-water table at the North New River canal, on the water level in the North New River canal, in the discharge section of the borrow canal, and in the pumped stretch of the borrow canal. Pumpage over the plugged section was measured by Pitot tube or current meter, and total discharge from the borrow canal into the North New River canal was obtained by use of the current meter.

"The elevation of the ground surface is 6.0 feet at the North New River canal and rises to 6.6 feet about 1/2 mile out. Thus, water was pooled above ground surface about 1-1/2 feet for the January 25 test, was about at ground-surface level for the tests on February 14 and 15, and was below ground surface for the test of February 24.

"The seepage pickup for the discharge section of the borrow canal is the small difference between two relatively large measurements, both subject to a certain error. The measurement at the North New River Canal actually serves as a check on the pumpage, and the computed seepage inflow is not accurate enough to be of much significance, except to show that the rate is very much smaller than that in the pumped section which is under greater head differences. Table 1 gives the pertinent data on these four tests.

Table 1.--Elements of seepage measurements on Levee L - 35 - A
Approximately 15 miles west of Ft. Lauderdale, Fla.

Date	Ground Water at NNRC	In pumped section of borrow	In discharge section of borrow
<u>WATER ELEVATIONS</u>			
1/25/50	7.75	3.90	--
2/14/50	6.35	2.52	5.15
2/15/50	6.30	1.55	5.19
2/24/50	6.00 4	2.00	5.12

Table 1.--Elements of seepage measurements of Levee L - 35 - A
Cont'd

Date	Length (ft.)	Area (ac.)	Measured pumpage (CFS)	Corrected seepage (CFS)	Seepage rate	
					Per acre (CFS)	Per lin. mile (CFS)

DATA ON PUMPED SECTION OF BORROW CANAL

1/25/50	660	1.21	21.5	20.0	16.5	160
2/14/50	650	1.19	17.6	16.4	13.8	133
2/15/50	1,000	1.84	25.4	20.4	11.1	106
2/24/50	800	1.47	8.8	8.8	6.0	58

DATA ON DISCHARGE SECTION OF BORROW CANAL

		Discharge at NNRC (CFS)	Seepage pickup in stretch (CFS)	Seepage rate Per acre Per lin. mile		
1/25/50	Pumps discharged directly into North New River					
2/14/50	1,500	2.8	19.9	2.4	.86	8.4
2/15/50	1,500	2.8	26.0	.6	.21	2.1
2/24/50	3,575	6.6	11.1	2.3	.35	3.4

Drainage Studies - M. H. Gallatin, Homestead, Florida. - "Readings on the natural cover and check areas have remained well above the wilting point nearly all of the month except during the period February 23 through February 26 when we had approximately one-half inch of rain.

"There has been little or no breakdown of the shavings material while there has been a good bit of breakdown for the pine straw and grass mulched areas. Sampling of this area on February 27 and analysis of the sampling for nitrate nitrogen gave the following results:

P.P.M. Nitrates	Plot
1.9	Natural cover
2.1	Shavings
12.5	Check
66.0	Pine straw
126.0	Grass

"These plots have been in operation for about 2 years. It will be noted from the above figures that shavings break down very slowly. Our study has shown that shavings can be used as a mulch but that grass or pine straw is much better.

"In connection with our nitrate leaching studies, during this period of low rainfall analysis of samples collected from our cooperative areas have shown that there has been no loss due to leaching, but in the areas where $(\text{NH}_4)_2\text{SO}_4$ was applied there was a steady decrease. This is no doubt due to release of NH_3 into the air. These losses are substantiated by studies several years ago in the tropics where field and laboratory studies showed that the loss of NH_3 was quite appreciable when applied to the surface of neutral or alkaline soils.

"Samples analyzed from our chloride line in the Miami area showed definite increases in much of the area. Though the rise was not alarming I believe it showed that the barriers were not put into operation as early as they should have been.

"Samples collected and analyzed from our lines in the Homestead area showed that the barriers are effective. The contamination in the areas between the structures is caused by two factors: (1) in areas where farmers are pumping from deep rock ditches we are finding definite increases in the concentration and (2) there is an increase in the concentration in the areas where small ditches run out into the ocean. In many of these small ditches gates had been installed, but they leaked badly and allowed the tides to back up into the road ditches. As we have stated in the past to get complete control in this area all of the small ditches should have controls put in them if we are to have good over-all control in the area.

"In our chloride tolerance studies we have found that with good cultural practices tomatoes will produce under higher concentration than we have previously found. We hope to have a good bit more data on tolerance by the end of this season.

"In connection with the Highlands Water Control Plot, we have in the past been stymied by not having a good outlet for the water we pumped off this plot. I believe within the next year this entire area will be in a drainage district. The initial meeting of the landowners has been called for March 17 when plans for forming such a district will be discussed. We have, on many occasions discussed with the farmers of this area, proper outlets and recommended what we felt was adequate to take care of the water in the area."

IRRIGATION AND WATER CONSERVATION DIVISION

Water Spreading for Recharge of Underground Basins - A. T. Mitchelson, Dean C. Muzkel, E. S. Bliss, and Curtis E. Johnson, Berkeley, Calif.-San Joaquin Valley.-The North Kern Water-Storage District has completed treatment of about 4 acres of spreading area, with cotton-gin trash as an experiment in large-scale spreading, by the addition of this type of agricultural supplement to the soil. It is hoped to obtain percolation rates somewhat comparable to the percolation rates recorded on the small experimental ponds of the District. This will be the first chance the cooperating agencies have had to make this comparison. The gin trash was hauled by truck and trailer from a waste dump and successfully spread with equipment ordinarily used to spread gypsum and fertilizer. The cost of hauling and spreading amounted to more than \$100 per acre, but it is believed this cost can be materially reduced if the experiment proves successful. The 4-acre tract is adjacent to the Minter Field test ponds used for experimental work.

"After a conference held at Berkeley, engineers of the Pacific Gas and Electric Co. visited our Bakersfield experimental spreading project. Resulting from this visit the technical personnel spent several days working with people of the Company on a water-disposal system at their Rosedale steam-electric plant. The company pumps about 9 acre-feet of water per day from the basin underlying their land, for cooling equipment, and is anxious to restore any surplus to the ground-water supply. After looking over our laboratory and experimental ponds, the group visited the proposed spreading area of the Company, and it was decided to drill a number of deep holes to determine the presence, if any, of hardpan or other barriers. The holes were drilled by the Company and logged by the laboratory technicians, and a suggested layout, together with permeagraphs of the holes was submitted to the Company. The plan calls for four spreading basin on the 15-acre tract. When gin trash is available, Basin No. 1 is to receive a 2-inch application. Number 2, very similar to No. 1, is to be left untreated for control to measure relative effectiveness of the gin trash. The third basin will probably be planted to Bermuda grass, and No. 4 will be left untreated. Details of incubation and getting the grass started were discussed with the Company engineers. Acceptable measuring devices for input of water will be installed. The fields are now being leveled and diked. This will make the second large experimental unit we will have for comparison of percolation rates.

"At the Wasco pond area two more cores were secured with the Utah power auger and attempts made to encase them in the split lucite tube obtained several months ago from Logan. The lucite tube is about one to two millimeters larger in diameter than the soil cores, and moreover is not round, due to the removal of the saw kerf when it was split. To overcome this difficulty the top 2 inches of the cores were coated with a thick solution of cellulose acetate. After the sleeves were in place, rubber cement was also forced into the crack between the core and the wall. This method failed to stop the movement of large amounts of water between the core and the side.

"If the cores are taken while the soil is fairly wet--near field capacity--they apparently tend to swell in the tube and little water flows between the core and the tube wall. However, there are disadvantages to taking wet cores, and moreover it will be necessary to dry them down at times after they have been encased so that is not the answer. Trying another tack, one of the extra coring bits has been cut out so that its inside diameter is now 1 mm. larger than before. An attempt will be made to get a core with this bit while Dr. McCalla is at the laboratory, and try it in the lucite sleeve.

"Soil samples from six percolation tubes were plated and total counts made. These samples were obtained from tubes which had been percolating for a period of 83 days. All tubes were initially packed with disturbed soil and a constant head of tap water supplied to the surface. Forty-three days prior to sampling, two tubes were given surface applications of redwood sawdust equal to 10 tons per acre. Two tubes were supplied with a 'Renex' solution at a concentration of 0.01 percent in tap water. ('Renex' is a calcium base detergent supplied by Atlas Powder Company.) The two remaining tubes were given no treatment and served as controls. The following tabulation briefly reports the influence of redwood sawdust and 0.01 percent 'Renex' solution on the number of aerobic organisms, organic matter content and percolation rate of soils under long submergence.

Treatment	Percolation rate at sampling time. Ml./Hr.	Percent organic matter	Millions of organisms per gram dry soil
Control	44	0.91	90
Redwood Sawdust 10 tons/Acre	44	.91	67
0.01% Renex Solution	3	1.30	175

"The results show that the redwood sawdust had little influence on percolation rate. The lower counts of micro-organisms appearing on the sodium albuminate agar plates on which these counts were made might indicate that the sawdust had some inhibiting effect on the growth of micro-organisms. The counts obtained on these tubes varied widely, however, and more replicates will be necessary to verify this possible effect.

"The 'Renex' solution definitely lowered the percolation rate and stimulated the growth of micro-organisms. It is possible that the organisms in the soil are able to attack the 'Renex' and utilize it as a food source."

Irrigation Studies - Earl W. Cowley, Grand Junction, Colo.-"The Mesa County Soils and Drainage Committee requested \$1,000.00 from the Mesa County Research Budget for drainage investigation in the valley. The County Research Committee tentatively approved \$800.00 of the \$1,000.00 requested. There is some indication that the Colorado A & M College may be in a position to make up the \$200.00 difference. It now seems quite certain that funds will be available to drill the necessary test wells for planning a drainage program. It is anticipated that this work will be started within the next 60 days.

"An informal agreement has been made with the Mesa College (a local Junior College) for the use of land and irrigation water with which to carry on irrigation and fertilizer studies. This land is located within the Mesa College Farm, near Grand Junction.

Performance Tests of Well Screens - Carl Rohwer, Ft. Collins, Colo.-

"Considerable difficulty was experienced in conducting the loss of head tests on the brass wire gauze screen on account of the clogging of the small openings in this screen with sand and lint. The constant handling of the gravel used in the gravel envelope produces a certain amount of sand which is carried into the screen openings by the water passing through the screen. Some of the lint comes from debris that collects in the water but in this case it came from a piece of cloth that was drawn into the pump impeller. This pump was dismantled to remove the cloth but before the clogging of the pump was noticed a considerable amount of cloth had been ground up by the impeller. No difficulty was experienced in washing the sand out of the gravel but removing the lint from the water is proving to be a problem. However, most of it was removed by pumping the water through a cloth screen. It is hoped that no further difficulty will be experienced from this cause.

"Arrangements were made for purchasing an elevator to move the sand and gravel from the floor of the laboratory to the test tank. This elevator will eliminate much of the work of handling the sand and gravel for the tests. A washer will be included in the elevator for removing the fine sand from the gravel.

Seepage Losses from Irrigation Channels - Carl Rohwer, Ft. Collins, Colo.-

"The computation of the results of the seepage tests made last year with the Soil Conservation Service permeameter was completed. These tests were made in pairs to find out whether consistent results could be obtained with the permeameter. Some of the tests checked exactly and all were in reasonably close agreement. The tests show however that the manner of placing the permeameter in the soil affects the results. The seepage rate was much more when the permeameter was pressed into place than when it was set by pounding it down."

Irrigation Studies - F. B. Hamilton, Lincoln, Nebraska.-"Reports submitted to cooperators regarding tests run on canvas hose for conveying irrigation water contain the following information:

1. Failure under pressure was due to thread failures in the seam.
2. Recommended maximum working head is 6 feet because of excessive leakage above that point.
3. Calibration of various types of outlets for distribution to individual rows were given."

Irrigation Studies - Vaughn E. Hansen, Logan, Utah.-"Following the recent meeting at Logan, Utah, to discuss sub-surface tillage experiments in the Tremonton area (to be conducted jointly between the Experiment Station and Operations and Research of the Soil Conservation Service) a further clarification of the problem was obtained from Mr. Blaine Morse, District Conservationist, Tremonton, Utah, by D. F. Trussel and myself recently. Mr. Morse is intensely interested in the development of this type of research in the Tremonton area. He will locate typical examples of sub-surface tillage for field inspection early this spring as agreed in the recent conference at Logan. There is a growing need for fundamental research on the value of sub-surface tillage to define the variables involved. While at Boise, I was confronted with this problem in connection with the irrigation of sugar beets. The practice is growing, but fundamental information on its value is lacking. There is a decided feeling that extreme benefits are to be gained under certain conditions. It seems to be a definite research obligation to investigate these conditions for those concerned.

"F. M. Warnick, Area Engineer for the Weber Basin, U. S. B. R., recently met with Dr. O. W. Israelsen and myself to discuss the feasibility of cooperative drainage study in the Weber Basin. The Bureau of Reclamation is very much interested in the Experiment Station and the Soil Conservation Service assisting in the

fundamental research to be conducted on drainage in this area. The effectiveness of the following three types of drainage will be determined for the area: (1) an open drain, (2) a closed drain, and (3) a pumped well. These developments will be formulated more specifically when Mr. Warnick obtains district approval of the cooperative research.

"Excellent information was obtained during the month from district conservationists, leading farmers, and sugar beet company field men on the irrigation of sugar beets. Meetings were held in Ogden, Utah, Murray, Utah, and Tremonton, Utah, in the district conservation offices. All produced excellent results, not only as far as the bulletin was concerned, but also in creating a definite interest in the irrigation of sugar beets in these areas."

Irrigation Studies - Fred M. Tileston, Ontario, Oregon.--"It was determined at a later conference with Mr. Swarner of the Bureau of Reclamation that it would be desirable to include 1949 water use records in the over-all water use study. A large part of the month was devoted to securing the data for the year 1949 and integrating it into the over-all water use study. The 1949 average water use for the Owyhee Project was 5.10 acre-feet per acre. Inasmuch as this is about the same amount of water that was used at the start of the research project it appears that the problem is one of continuing nature and will require further intensive work if a satisfactory solution is to be reached for it."

Irrigation Studies - Norris P. Swanson, Amarillo, Texas.--"The dry weather has continued with only 0-33 inches of rain during February. Moisture in the surface 4 to 5 inches of soil on winter wheat plots, not irrigated since planting, was at the wilting point or below at the end of the month. Adequate moisture is available from 6 to 12 inches and little moisture has been used below 12 inches.

"The irrigated winter barley plots were destroyed by Green Bugs (aphides) in late February. Winter wheat plots in the same area have been heavily damaged. The winter wheat and winter barley plots that were irrigated in late January were apparently not injured by subsequent cold weather when free water in the form of ice was still evident on the soil surface. These plots were possibly more heavily infested with the aphides due to a more lush growth during the period of mild weather.

"The winter wheat plots planted for differential irrigation treatments are infested with aphides but still have a good chance for survival.

"Plots of spring oats and spring barley were planted in February.

"Specifications were written during the month for the relocation of the irrigation well and pumping equipment, with provisions for new connections to the domestic water supply and irrigation distribution system, on the Amarillo Conservation Experiment Station."

4/21/50

